Lankester, protesting against the digging up of old names, suggested that an international committee should be formed, not to draw up a code of rules, but "to produce an authoritative list of names—once and for all—about which no lawyer-like haggling should hereafter be permitted. Twelve years have elapsed, and nothing of the kind has been arranged. On the contrary; the various committees that have legislated since have insisted on absolute priority, and we often read that such a decision has been arrived at by international agreement. It is not so, a great body of zoologists in this country protest, and hope that something will be done towards carrying out the proposal here briefly set forth, which seems to be the only proper step to take in order to prevent the confusion with which we are menaced.

SPECIAL ARTICLES

SOME RESULTS OF A SERIES OF TESTS MADE BY THE WIRE-BASKET METHOD FOR DETERMINING THE MANURIAL REQUIREMENTS OF SOILS

A NUMBER of methods for determining the manurial requirements of any given piece of land have been proposed from time to time, since it is well known that the mere chemical analysis of a soil often fails to be of real value in this connection.

One of the most reliable methods consists in making actual field tests with various fertilizers applied in definite amounts to plots of land of equal size, one or more of the plots being left untreated to serve as a check. The effect of the various manures applied is measured in terms of the crop harvested, and thus the requirements of the soil for specific forms of plant food is made evident. The chief objection to this method is that climatic conditions are not always favorable for the best results in any one season, in addition plant diseases and insect pests may be active, hence it often happens that it becomes necessary to conduct the field experiments for a number of years before definite conclusions can be reached.

During the year 1904, the Bureau of Soils of the United States Department of Agriculture, devised a promising method for ascertaining the manurial requirements of soils. This has been published as Circular 18, Bureau of Soils, "The Wire-Basket Method for Determining the Manurial Requirements of Soils." Briefly, it consists in treating samples of the soils in question with definite amounts of various fertilizers, and placing the treated soil samples in wire-baskets which are then coated with melted paraffin, and growing wheat in the soil in these baskets for short periods of time. The amount of water transpired by and the green weight of the plants are taken as indicative of the requirements of the soil for specific manurial constituents. The value of the method consists largely in the fact that results can be obtained in a period of two or three weeks.

In the early part of 1908 the writer was requested to make a series of wire-basket tests of soil samples from Boydton, Va.; these samples were taken on a farm, the property of the Boydton Institute. The soil of this region is characterized by one who has worked it for a number of years, "as having tilling qualities of about the average for a heavy clay soil . . . if plowed at the proper time, subsoiled and kept stirred it presents no unusual difficulties." The two soils represented by the following samples are undoubtedly of the same character, and differ from each other mainly through the different treatment which each has received.

A rough mechanical analysis of one of the samples (*a*) by the beaker method, made in this laboratory, gave the following result: Sand 29 per cent., clay 18 per cent., silt 53 per cent. A deficiency of humus was shown by the small amount of volatile matter present (4.76 per cent.) and by the absence of a dark color in the soil. By actual determination the amount of humus was found to be 1.40 per cent. The gravel was found to be composed mainly of quartz.

Two samples of soil were used in making these tests, designated as (a) and (j), having the following history: (*a*) "East end of corn lot on the 300-acre tract. Cleared about

1887. Cropped with corn and oats (poorly) every second or third year and idle between. Fertilized 1907 with a cheap corn fertilizer. Yield 10 to 12 bushels of corn per acre."

(j) "Cherry tree lot, west of campus. Probably cropped since 1894. Was once part of the campus. Cropped with corn and potatoes, alternately, clover and oats also planted twice, potatoes in 1906, millet in 1907, but failed because of drought. Some sweet potatoes planted there in 1907 but were also poor because of the dry season. Corn yielded there about 40 bushels to the acre. None of this land has been fertilized more than twice in thirty years and then with wood ashes or a cheap commercial fertilizer."

These soil samples were subjected to the following treatment: The air-dry soil was rolled with a small wooden roller to crush the lumps and sifted through a sieve having meshes of 2 mm. Three-pound portions of the pulverized soil were each placed in a separate tray moistened with distilled water and treated with various fertilizers.

In the case of sample (a) to portion I. was added nitrogen, as nitrate of soda, at the rate of 200 lbs. to the acre; and phosphorus, as acid phosphate (containing 14 per cent. of soluble phosphoric acid) at the rate of 600 lbs. to the acre. Portion number II. received nitrogen, as sodium nitrate, at the rate of 200 lbs. per acre, and potassium, as sulphate of potash at the rate of 200 lbs. to the acre. Number III. received phosphorus, as acid phosphate (14 per cent. soluble phosphoric acid), at the rate of 600 lbs. to the acre; and potassium, as sulphate of potash, at the rate of 200 lbs. to the acre. Number IV. received nitrogen, as nitrate of soda, 200 lbs. to the acre; phosphorus, as acid phosphate (14 per cent.), 600 lbs. per acre; and potassium, as sulphate of potash, 200 lbs. per acre. Number V. received the same treatment as number IV., and in addition calcium, in the form of slaked lime, at the rate of 2,000 lbs. per acre. Number VII. received nothing and served as a check.

Soil sample (j) was divided into five three-pound, portions. Numbers I., II., III. and IV. received precisely the same treatment as did numbers I., II., III. and IV. of sample (a). Number V. served as a check and was left untreated.

All of these various portions were allowed to remain in their respective dishes for several days, with occasional stirring and moistening in order to thoroughly distribute the fertilizers. Then, as nearly as could be judged, enough distilled water was added to each portion to supply the optimum or most favorable moisture content for plant growth, which according to Hilgard, is equivalent to from 40 per cent. to 60 per cent. of the water capacity of a soil. Each portion was divided into three approximately equal parts, and each part was placed in a wire basket; these baskets were of standard dimensions, 3 inches in diameter, 3 inches deep, mesh 3 mm., and contained about 1 pound of the prepared soil, which was well pressed into the bottom and sides of the baskets. The baskets containing the soil were then repeatedly dipped into a bath of melted paraffin-wax until a good coating was obtained. Six germinated kernels of wheat were planted in a row in the soil of each basket and a thin layer of clean white sand was placed on the top of the soil. The filled baskets were then weighed and placed in a greenhouse where favorable conditions for growth were maintained.

When the wheat plants had reached a height of about two inches enough distilled water was added to each basket to bring the weight up to the first weighing, and a paraffined paper disk was fitted about the stems of the plants and sealed to the sides of the basket by means of a small amount of melted paraffin-wax. By this device all escape of moisture from the soil was practically cut off except by way of transpiration through the plants. The baskets were again weighed, and thus the optimum weight was ascertained. The baskets were then returned to the greenhouses and maintained under favorable conditions for growth.

The amount of water transpired by the plants was ascertained by weighing each basket at intervals of three or four days.

After each weighing enough distilled water was added to bring the weight slightly above the optimum.

The experiment with sample (a) was carried on for fourteen days after the baskets were sealed. With the sample (j) the test was conducted for eighteen days. At the end of these periods the green plants were cut off close to the paper disks and weighed.

The following table gives a summary of the results of these tests.

SOIL SAMPLE (a)

Series Three Baskets Each	Fertilizing Constituents Added	Total Water Transpired. Grams.	Weight of Green Plants. Grams.
I.	Nitrogen and phosphorus	134.9	2.796
II.	Nitrogen and potassium	165.2	3.840
III.	Phosphorus and potassium	102.0	2.130
IV.	Nitrogen, phosphorus and potassium	129.6	3.083
V.	N, P, K and calcium	144.4	3.445
VI.	Calcium	102.3	1.850
VII.	Blank, nothing	112.3	1.880

In this table a comparison of series I. with IV. and of I. with II. indicates a lack of potassium in the soil. A comparison of II. with IV. and of II. with III. shows but little, if any, deficiency of phosphorus in the soil. A comparison of III. and IV. and of III. with II. clearly shows a deficiency of nitrogen in the soil. With regard to calcium in the form of lime a comparison of VI. and VII. indicates that lime alone is of little or no value. It is of interest to note here that the actual application of lime alone to this soil under field conditions did not give any increase of crop. But, as is well known, the application of lime alone will give poor results on land deficient in nitrogen and in mineral constituents, especially potassium compounds. A comparison of V. and IV. indicates that lime used in conjunction with mineral fertilizers may be of value on this soil. In this table, as well as in the following one, it is noteworthy that the amount of water transpired keeps pace with the weight of the green plants; that is, the larger the green weight of the plants the greater is the total transpiration.

SOIL SAMPLE (j)

Series Three Baskets Each	Fertilizing Constituents Added	Total Water Transpired. Grams.	Weight of Green Plants. Grams.
I.	Nitrogen and phosphorus	160.5	2.970
II.	Nitrogen and potassium	212.5	4.278
III.	Phosphorus and potassium	146.7	2.632
IV.	Nitrogen, phosphorus and potassium	203.2	3.841
V.	Blank, no fertilizer	196.8	3.295

In this table a comparison of series I. with IV. and of I. with II. shows a deficiency of the soil in potassium. A comparison of II. with IV. and of II. with III. does not indicate a lack of phosphorus; in fact, it raises the question as to whether or not the acid phosphate may have done actual harm in the case of III. With regard to nitrogen a comparison of III. with IV., with II. and with I in turn shows a deficiency of this element.

On the whole the results of tests with samples (j) agree with the results of those with sample (a). Though from these tests sample (j) would seem to be in a better chemical condition than sample (a), in that (j) responds less readily to treatment with fertilizers than does (a). Compare VII. of Table (a) with the other series of Table (a) and V. of Table (j) with the other series of Table (j). A bit of evidence bearing out this contention is to be found in the statement that soil (j) has actually yielded 40 bushels of corn per acre while soil (a) has given but 10 to 12 bushels of corn to the acre.

From all these tests it appears that the soil of the Boydton Institute is deficient mainly in nitrogen and potassium and in humus. As a result of these tests and in view of the difficulty of obtaining a sufficient supply of farmyard manure at Boydton, the writer has advised the use of green manuring, for this purpose turning under cow peas, or crimson clover, to be stimulated by the application of potassium, in the form of muriate of potash, and small dressings of available phosphates.

The president of the Boydton Institute, Mr. John R. Hague, at whose instigation these experiments were made, has agreed to conduct

at Boydton field tests which shall be comparable to these wire-basket experiments. The main crops to be grown are corn and wheat.

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SUDAN III. DEPOSITED IN THE EGG AND TRANSMITTED TO THE CHICK

IN repeating the experiments reported by Dr. Oscar Riddle[1] in SCIENCE, June 19, 1908, p. 945, for the purpose of demonstration before the third session of the Graduate School of Agriculture of the United States, held July 6–30, 1908, at Cornell University, the results obtained by Dr. Riddle were confirmed; *i. e.,* Sudan III. fed to hens during the laying period stained red the layers of yolk deposited during the feeding of the Sudan. The amount of the stain used was much greater (20 to 25 milligrams at a dose) than Dr. Riddle for his special purpose found desirable, hence the yolks were strikingly colored, and always in concentric layers. Even when all the food eaten by the hen during the entire twenty-four hours was mixed with Sudan, the layers of the yolk were marked.[2]

[1] Riddle's paper was presented at the zoological meetings during convocation week at Chicago, 1907–8. He kindly gave to the authors personally the technique necessary for obtaining the colored eggs.

[2] If any of the readers of SCIENCE desire to experiment with Sudan III. the following hints may be of service: Sudan III. may be purchased of any dealer in microscopic supplies, *e. g.,* the Bausch and Lomb Optical Company, Rochester, N. Y. It is practically tasteless and the dry powder may be mixed with the food or it may be dissolved in olive oil and that mixed with the food. The dose is small (for a hen, 3 to 25 milligrams). The larger doses give more brilliant coloration. Water, glycerin and formalin do not dissolve either fat or Sudan III., hence watery solutions of glycerin and formalin are good preservatives of tissues containing the stained fat. The most satisfactory preservative found both for the eggs and for the entire animals containing colored fat is 5 per cent. formaldehyde. (Strong formalin 10 parts, water 70 parts.) Eggs are best prepared by boiling 15 to 20 minutes, then the shell is removed from the large end and the white and yolk cut off in thin slices, holding the egg and knife under water. Sections through the germinal disk are the most instructive. For permanent support and preservation of the prepared eggs glycerin jelly has been found satisfactory.

In order to carry the investigation a step farther and to answer the question whether this coloring matter could be carried over to the chick, some of the "red eggs" were incubated, with following results:

1. As the yolk softened during the processes of growth of the embryo the layered mass became homogeneous and of a uniform pink. This was marked from the third day onward. For the first ten days the transparent embryo showed no sign of the color.

2. As soon as the developing chick began to deposit fat, at the seventeenth day of incubation, a minute mass of fat lying in the loose connective tissue between the leg and the abdomen was found with the characteristic pink color which depositing fat takes in adults fed with this stain. At this time the egg mass is of a nearly uniform dark red and almost enclosed within the body.

3. At hatching and several days thereafter the pink fat increased in amount, extending along the side of the sternum, the neck and head and finally appearing on either side of the back in the pelvic region. At the same time the yolk was losing its red color.

4. It was hoped that the peculiar fat of nerve fibers might take up some of this stain in the period during which myelinization is rapidly proceeding; but the nerve tracts showed only their usual glistening white.

To briefly summarize:

1. The specific fat stain, Sudan III., colors the fat laid down in the living hen and in the fatty portions of the yolk while the feeding experiments are in progress, and thus serves to give exact data concerning the time and amount of deposit.

2. The eggs so colored hatch, and the chick utilizing the yolk as food, produces fat in its own body colored as in the adult, showing in the most striking manner the transmission of a specific and unusual or foreign substance